Enerji Sektöründe Dijitalleşme

Barış Sanlı

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Ana fikirler

- Dijitalleşme son 80 yıldır vardı ve olacak
- Ama eğilimler doğrusal değil
- Algoritmalar dünyayı daha temiz yapmayabilir
- Çekici kavramlar gerçekler ile uyumlu değil
- Hangi teknolojiler kazanacak? Monte Carlo

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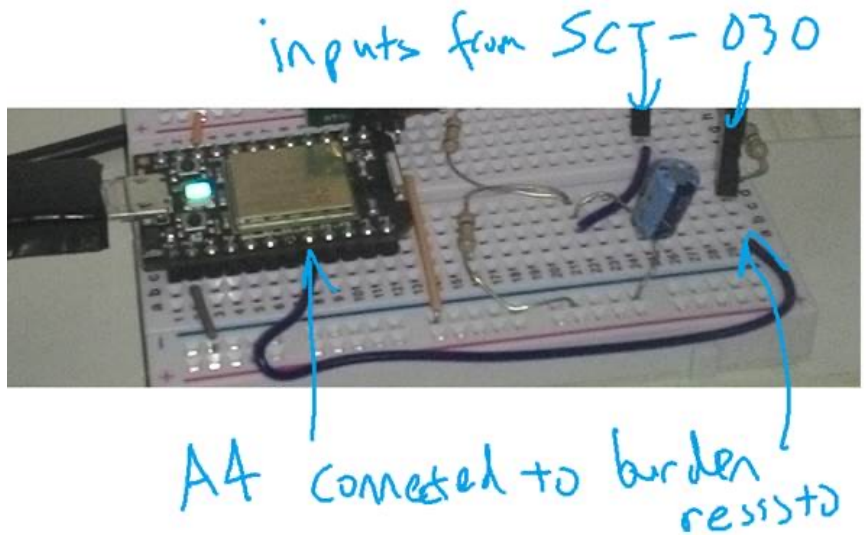
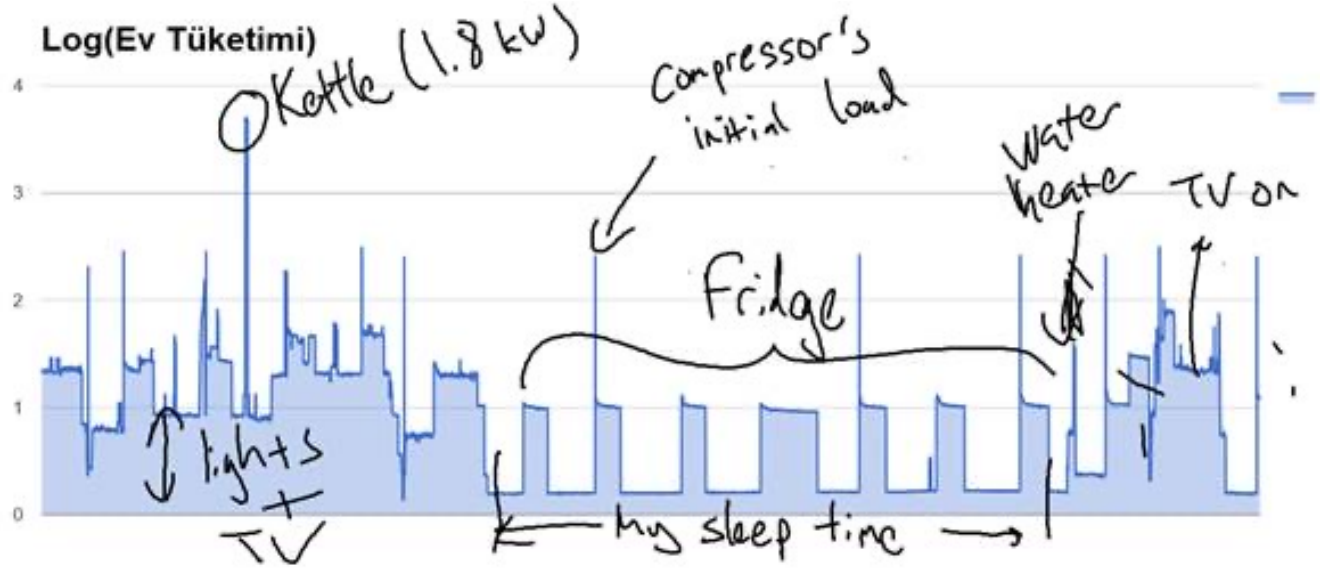
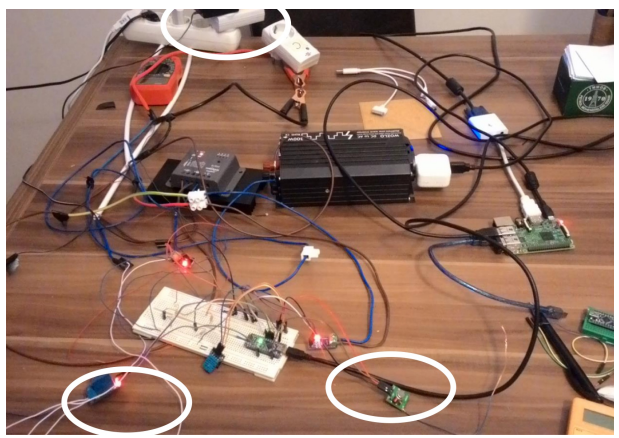
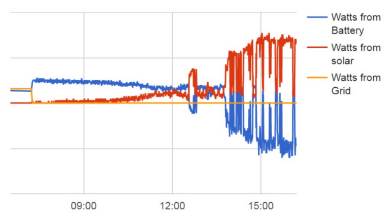
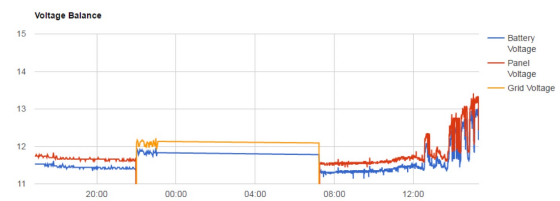
www.barissanli.com/electronics Elektronik hobi projelerim

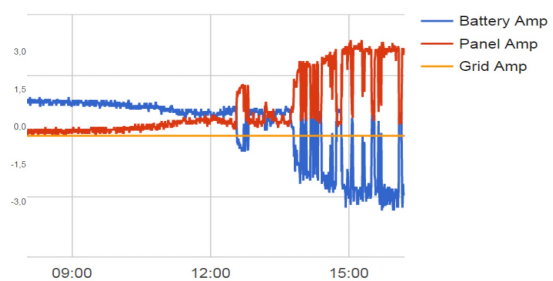












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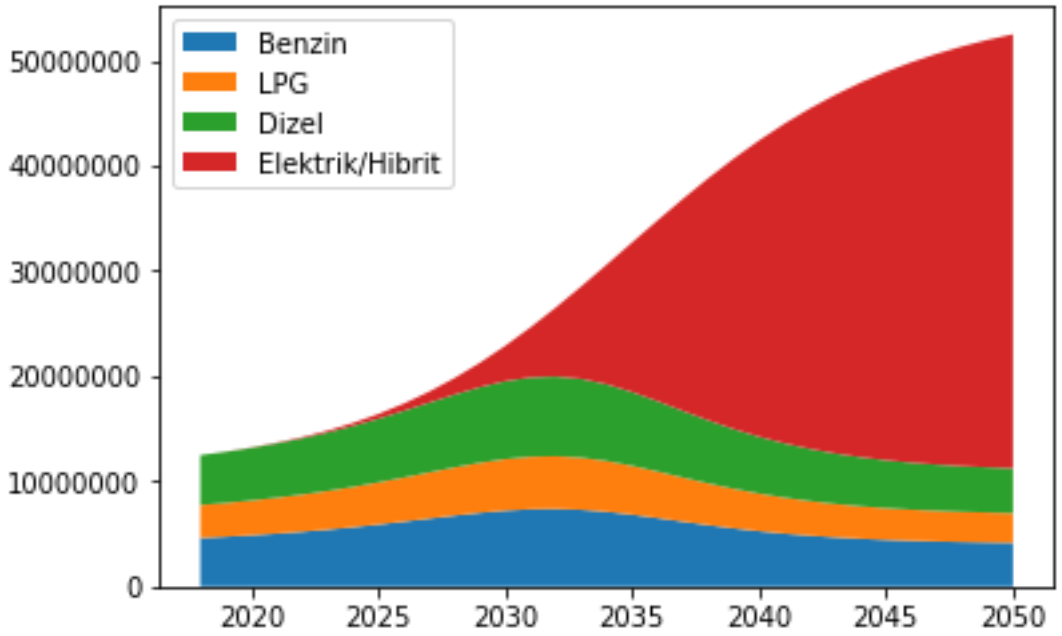
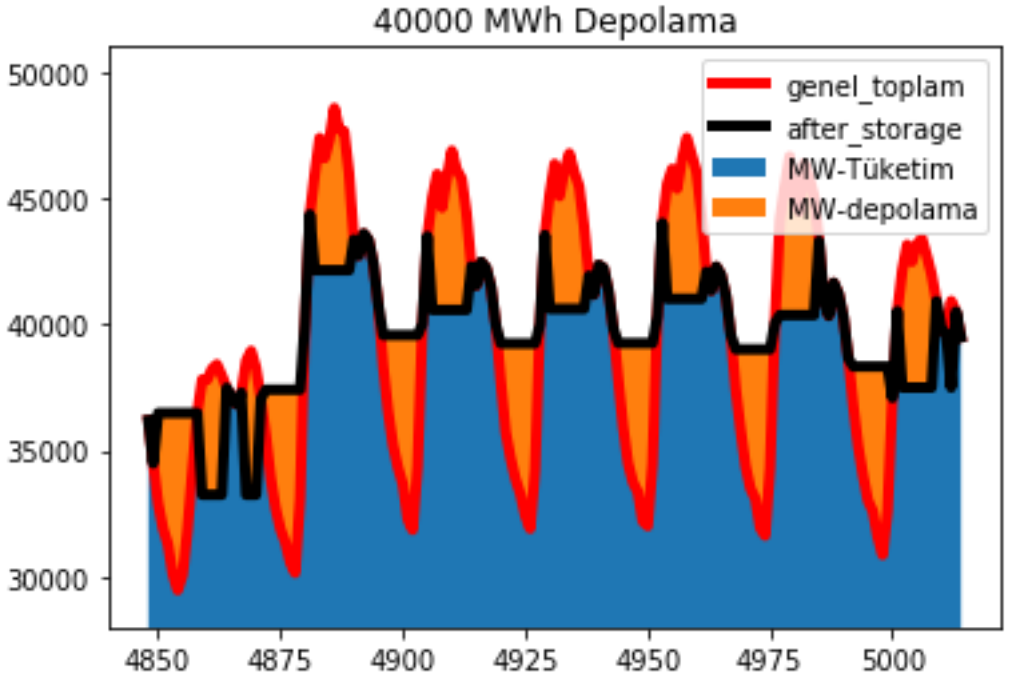
- Enerji depolama simulasyonu
- Türkiye elektrikli araba penetrasyon simulasyonu



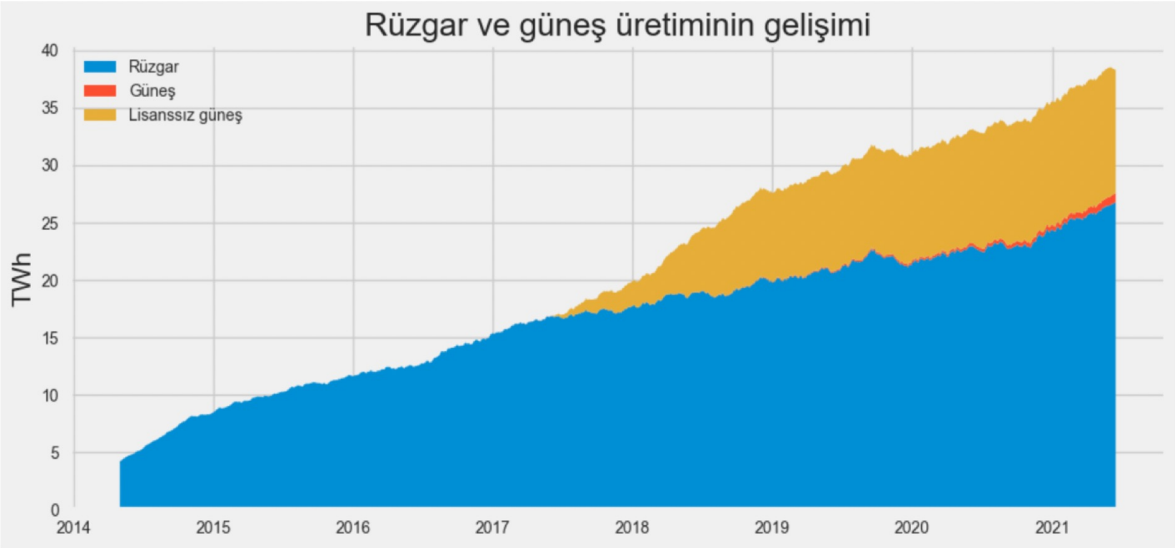


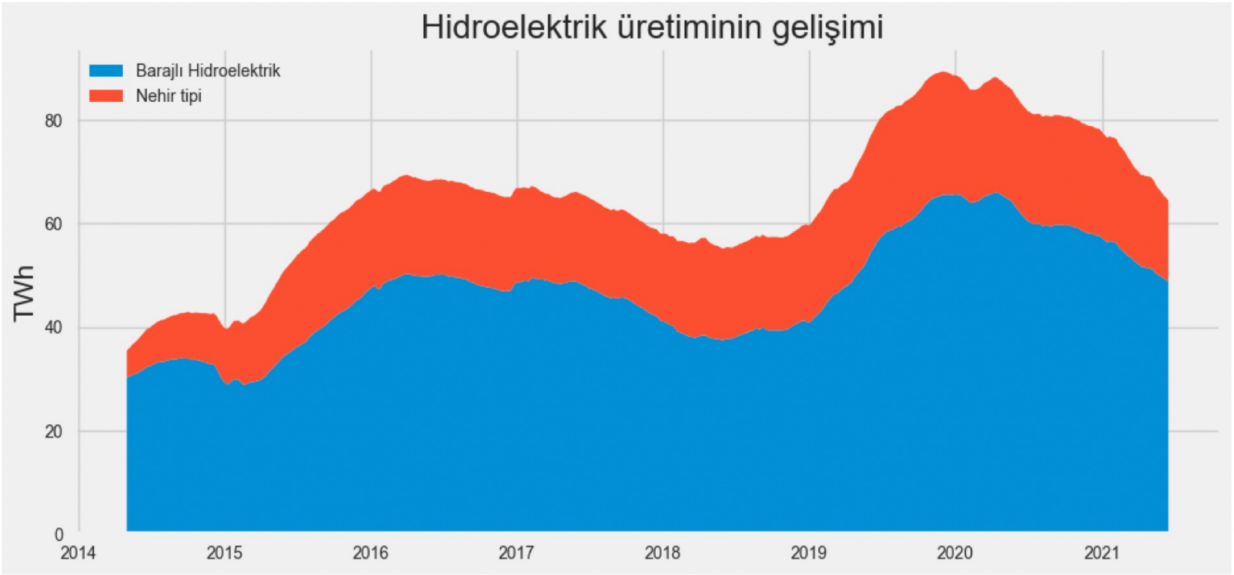
Enerji ≠ Elektrik

Dijitalleşme

- Dijitalleşme ile Temiz enerji ?
  - Petrol ve gaz da daha hızlı
- Farklı seviyeler var
  - Büyük operasyon , ticaret, tüketim
- Temel beklenti
  - Intermittent – Kontrol edilemez ama öngörülebilir
  - İşletme ve yapay zeka
  - Ör:
    - Dağıtım şirketi = Mikroşebekeler Federasyonu
    - Yapay zeka temelli adalamalı elektrik kesintileri
    - Elektrikli arabalar şebekeye elektrik satar mı?

Türkiye’de yenilenebilir üretim





http://barissanli.com/calismalar/2021/20210621-uzundonemli.pdf
Veri seti : http://barissanli.com/calismalar/2021/20210101-epias-raw.pkl
Jupyter Notebook: http://barissanli.com/calismalar/2021/202106-uzundonemli.ipynb

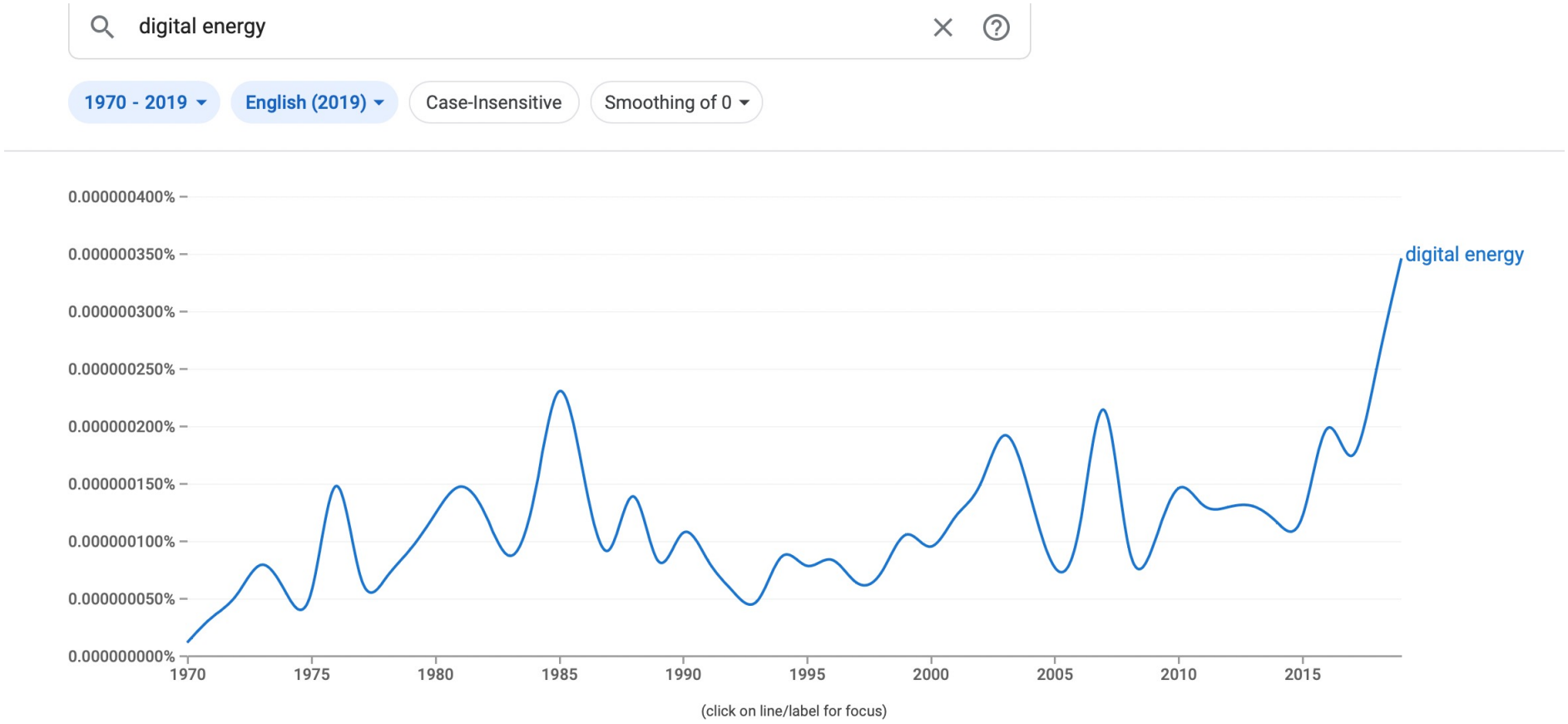
Dünyada süreç nasıl işliyor?

- IEEE, dünyaca ünlü yayınlar
- Araştırmacılar/bilim adamları -> Şirketler
- Şirketler -> Danışmanlık şirketleri
- Danışmanlık şirketleri -> CEO
- CEO -> Küresel sunumlar
- “Gelen/dünyayı kasırıp kavuracak” -> Trendler
- 3-5 sene sonra 1.adıma geri dön

Önemli sorular

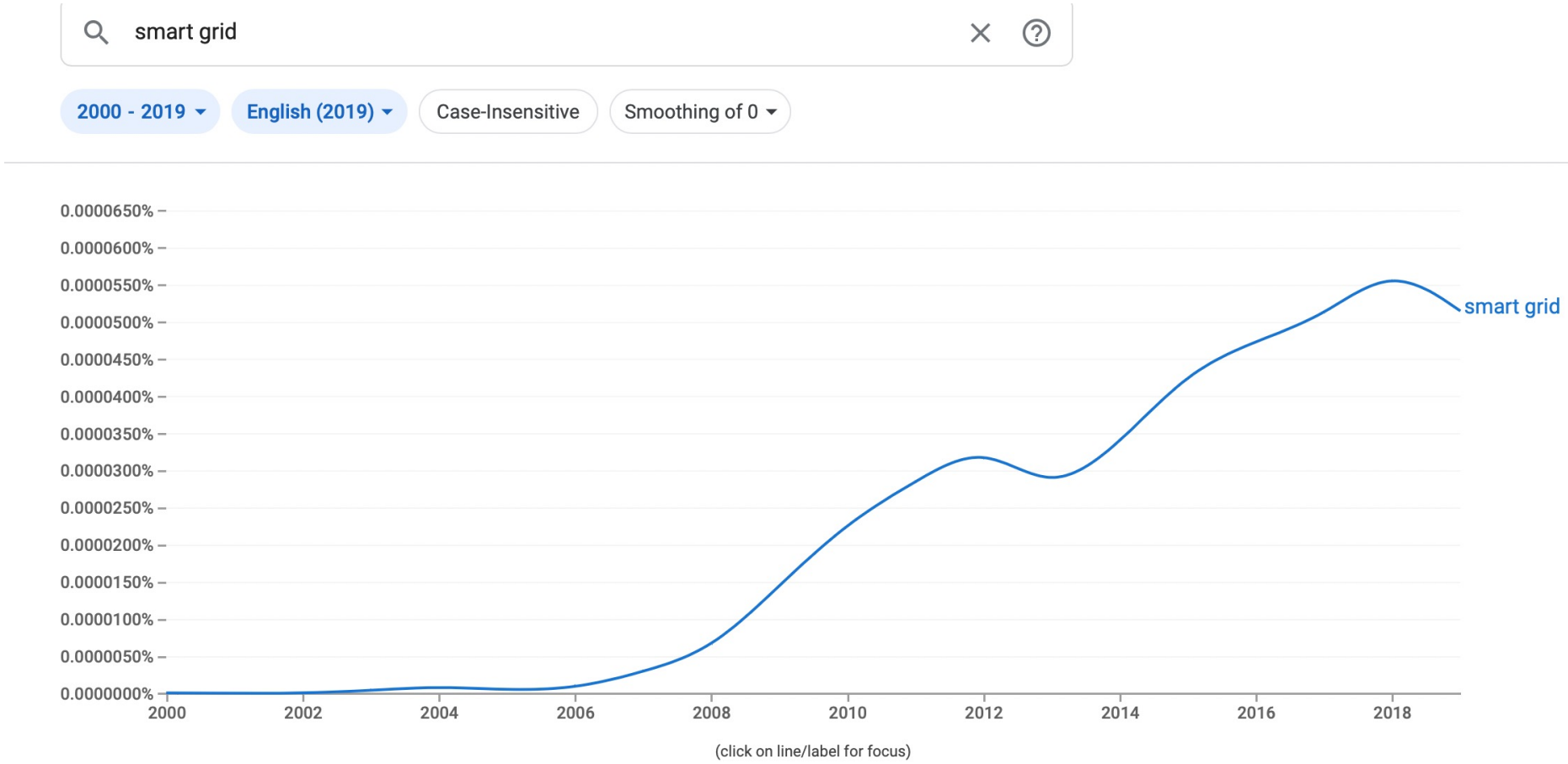
- 3 boyutlu TV'ler neden tutmadı?
- Tüketici elektrikli arabaları tercih edecek mi?
- Dağıtık bir enerji sistemi geliyor mu?
- Fosil kaynakların sonu mu? Sıfır ile net sıfır farkı?
- Tüketici değişmek istiyor mu?
- Dijitalleşme daha çok 1-0 değil daha fazla insani bilimleri öne mi çıkarıyor?
- Elektrifikasyon nasıl hızlanır?
- Yeni kavramlar gerekir mi? Güneşte mesela MW baz yük eşdeğer?
- Dijitalleşme diyoruz ama hep Python tarafındayız, çip-sensör tarafı tamamen ihmal edilmiş görünüyor.
- Enerji dönüşümünün kendi aklı ve hızı mı var?

Enerjide dijitalleşme – Yeni trend



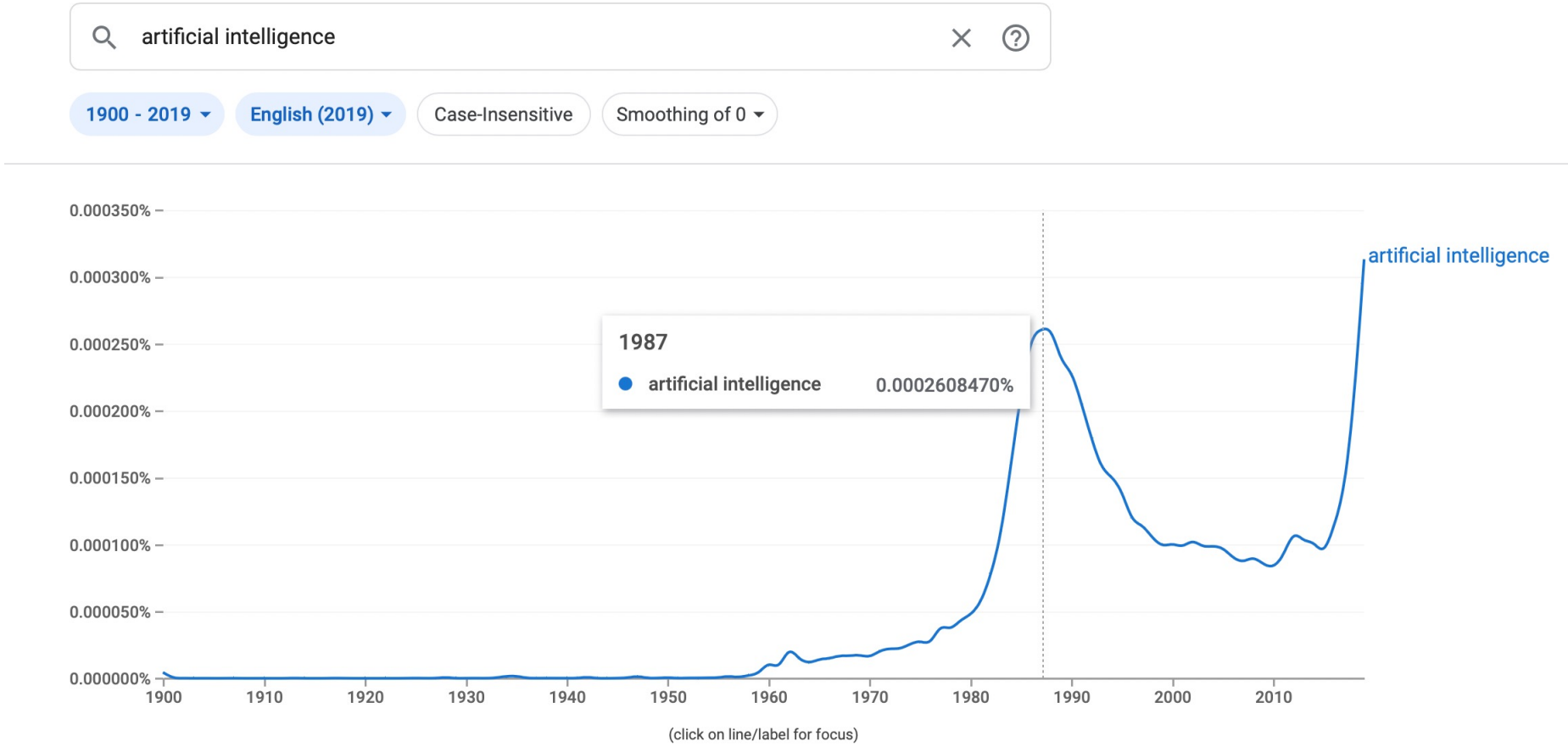
https://books.google.com/ngrams/graph?content=digital+energy&year_start=1970&year_end=2019&corpus=26&smoothing=0

Akıllı şebeke



https://books.google.com/ngrams/

Yapay zeka – Yeni trend



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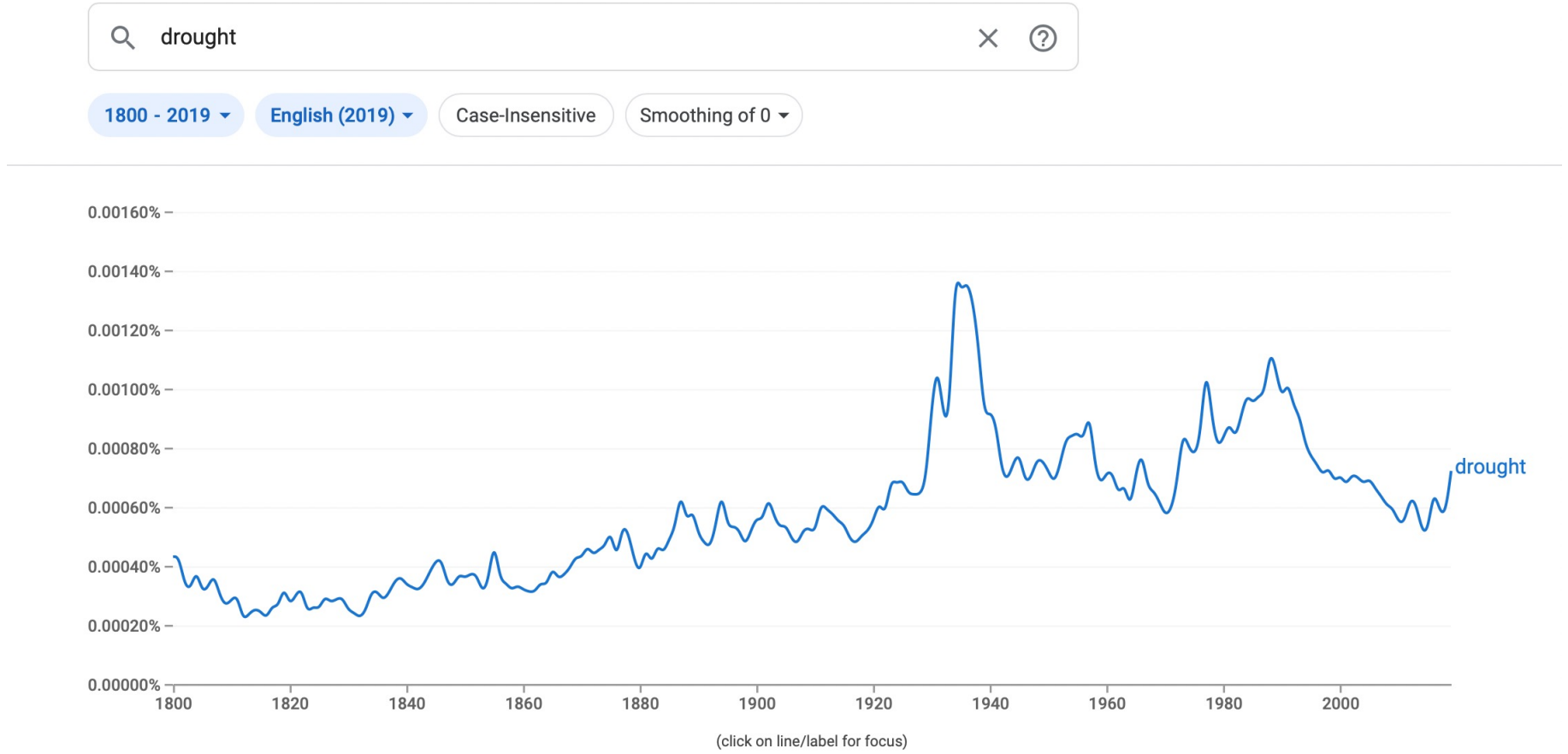
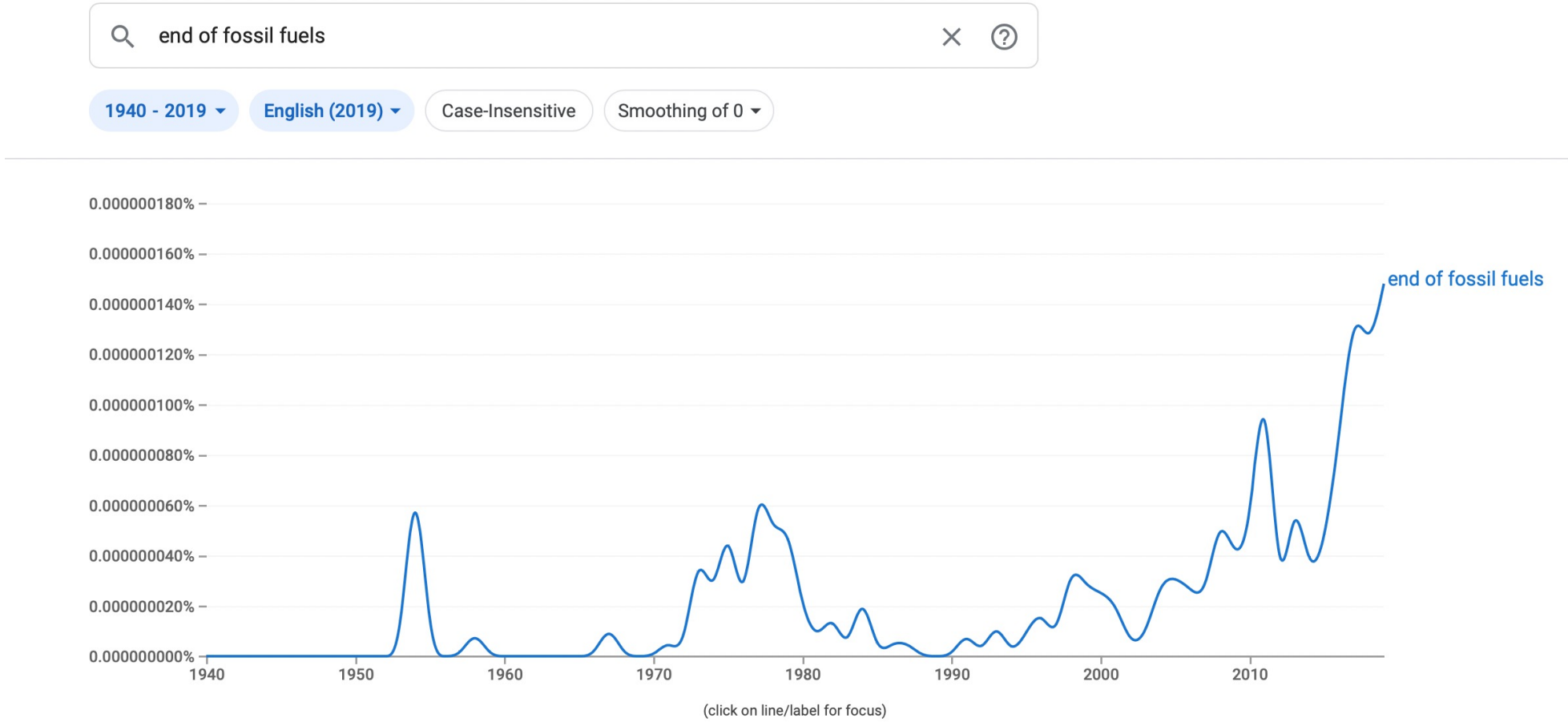
Kuraklık – giderek artıyor



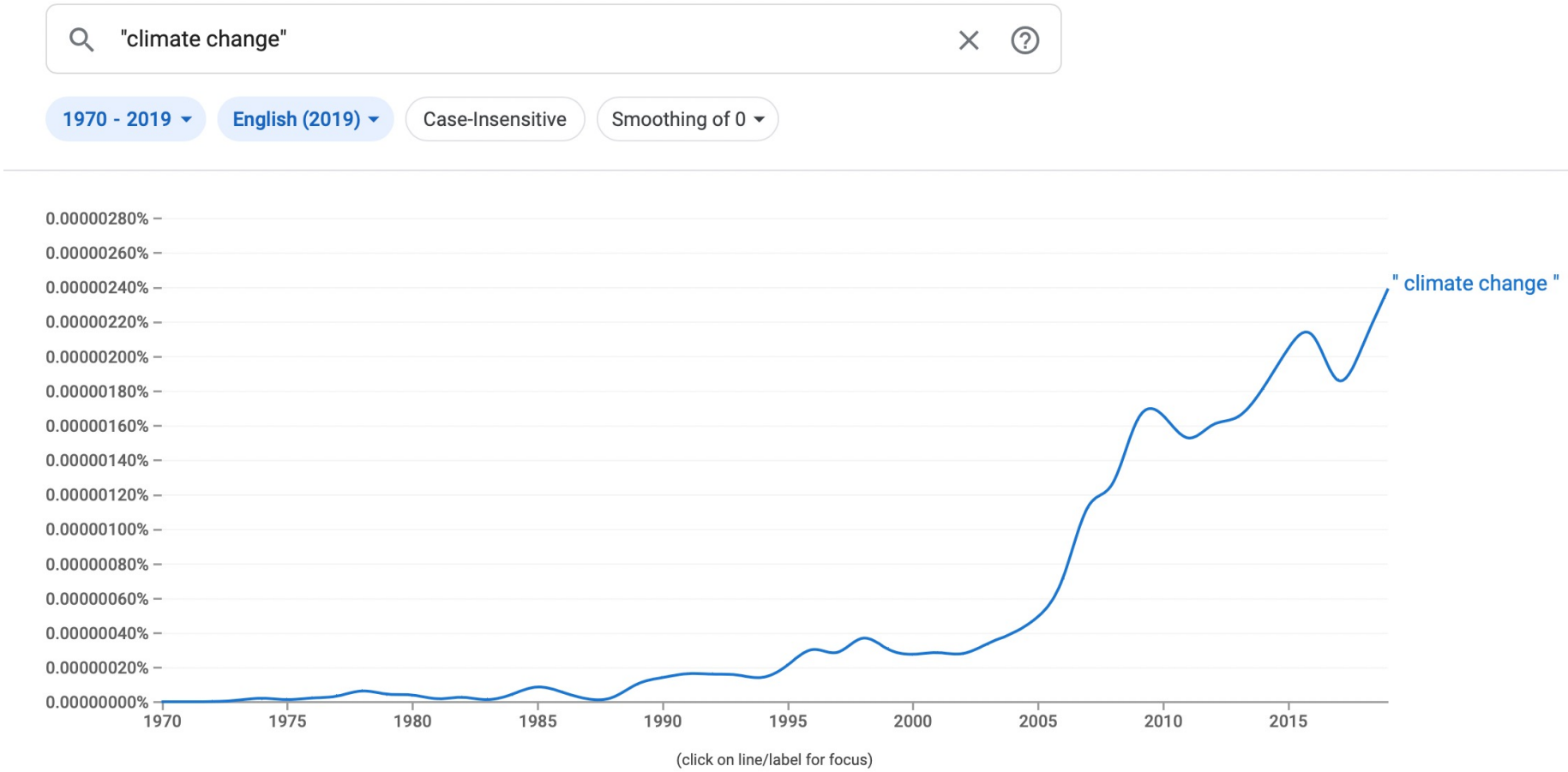
https://books.google.com/ngrams/graph?content=drought&year_start=1800&year_end=2019&corpus=26&smoothing=0

Fosil yakıtların sonu



https://books.google.com/ngrams/graph?content=end+of+fossil+fuels&year_start=1940&year_end=2019&corpus=26&smoothing=0

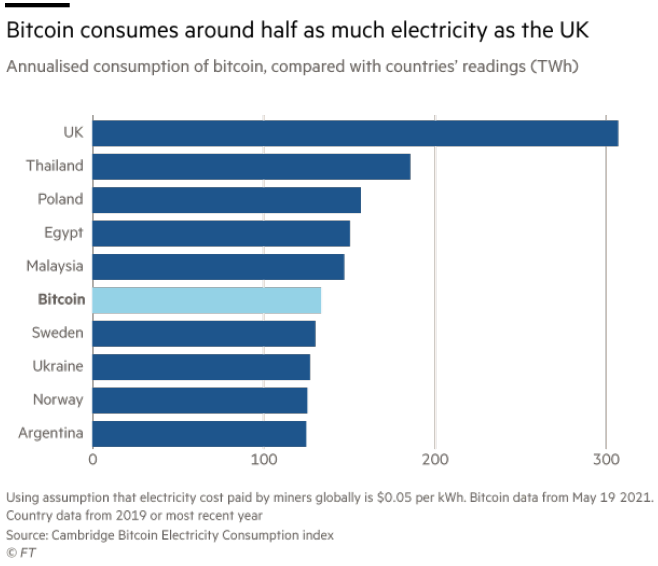
İklim Değişikliği – Yeni trend

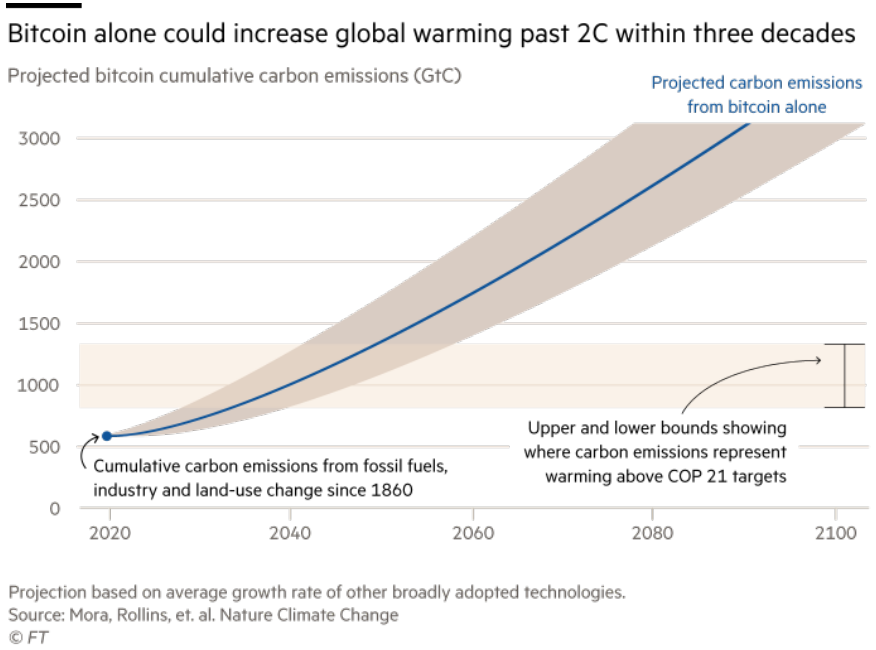


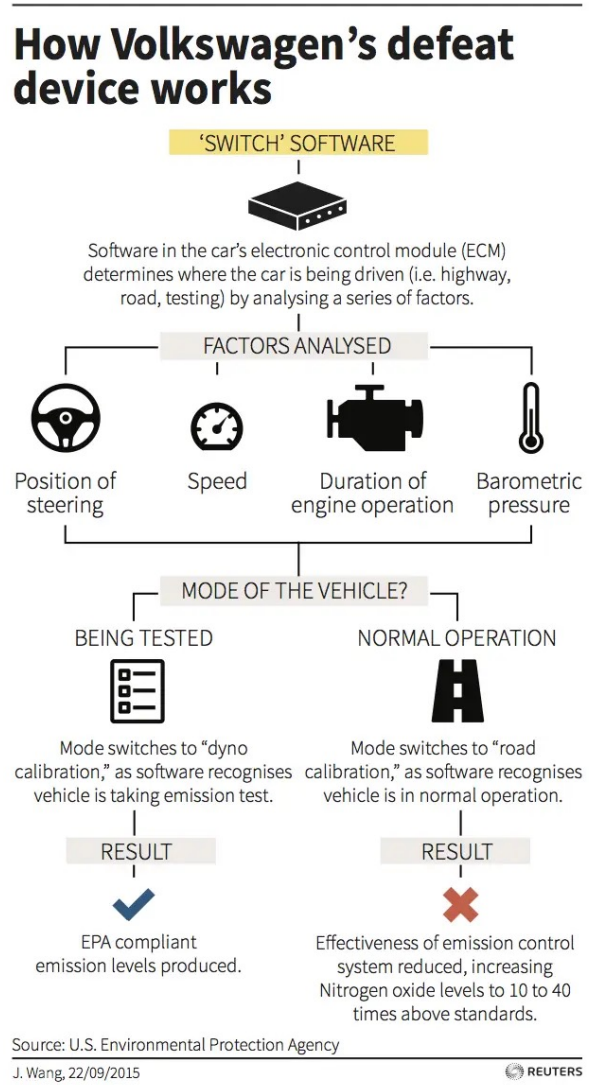
https://books.google.com/ngrams/graph?content=%22climate+change%22&year_start=1970&year_end=2019&corpus=26&smoothing=0

Dijitalleşme

- VW skandalının arkasında yatan sebep dijitalleşme
- Bitcoin (örnek olarak)
  - Algoritmalar dost mu düşman mı



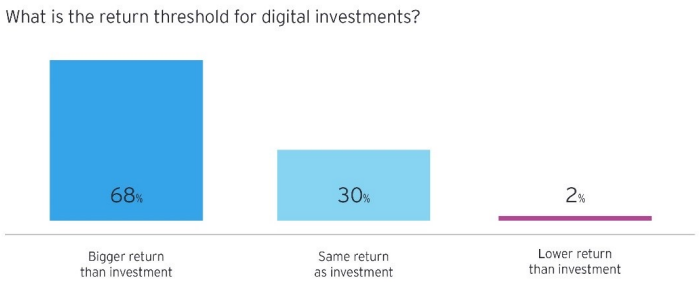


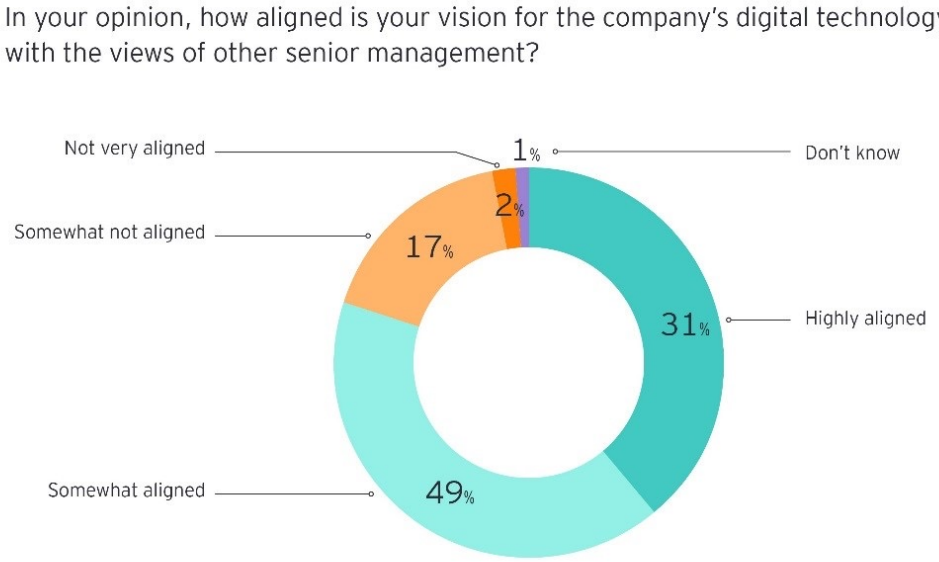


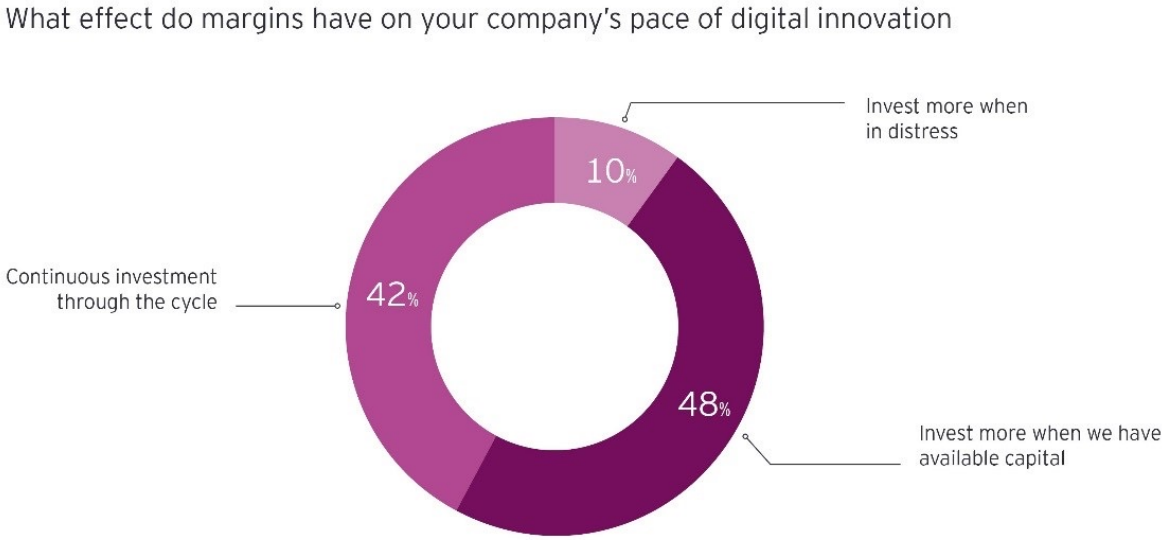
https://www.ft.com/content/1aecb2db-8f61-427c-a413-3b929291c8ac

https://www.businessinsider.com/heres-what-volkswagen-did-and-how-they-got-caught-2015-9

Petrol ve gaz da dijitalleşme

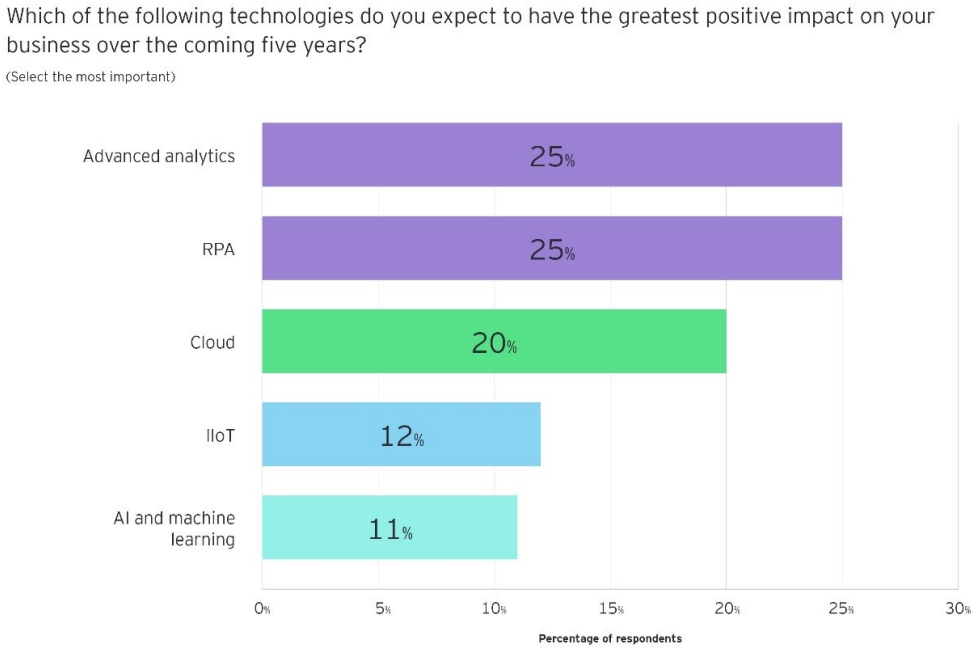


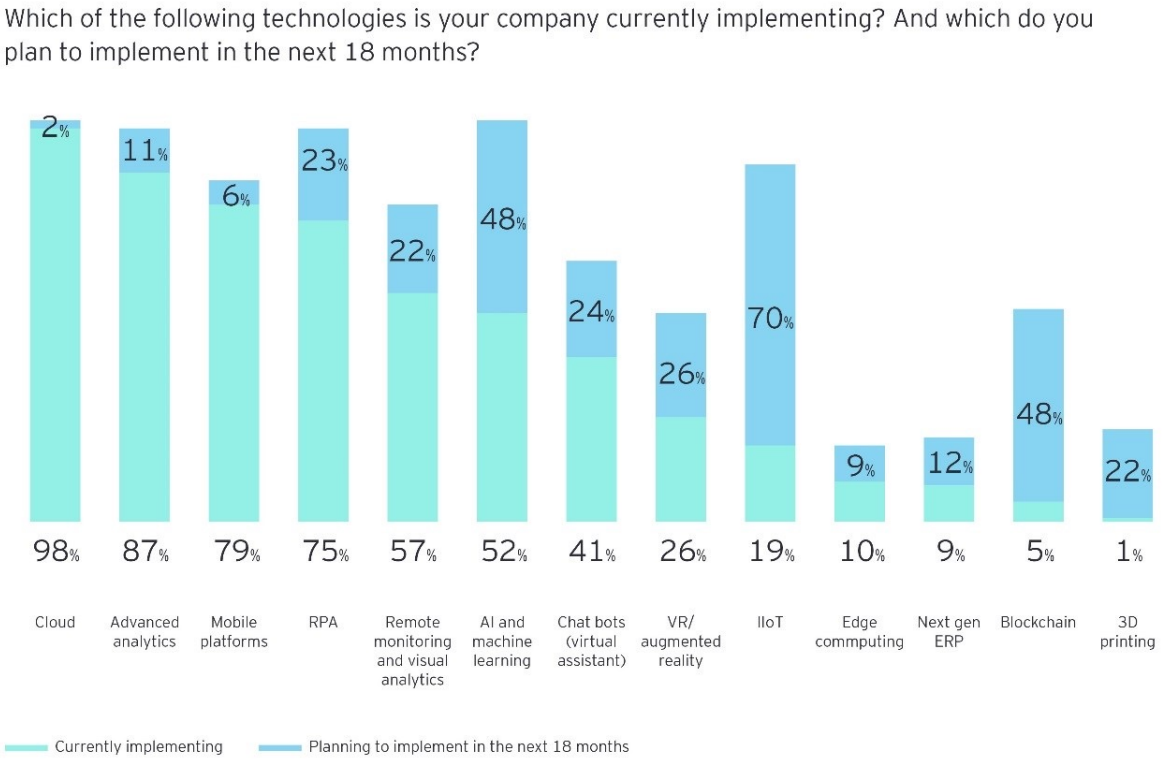




https://www.ey.com/en_gl/oil-gas/technology-can-light-the-way--but-do-you-know-where-you-re-going

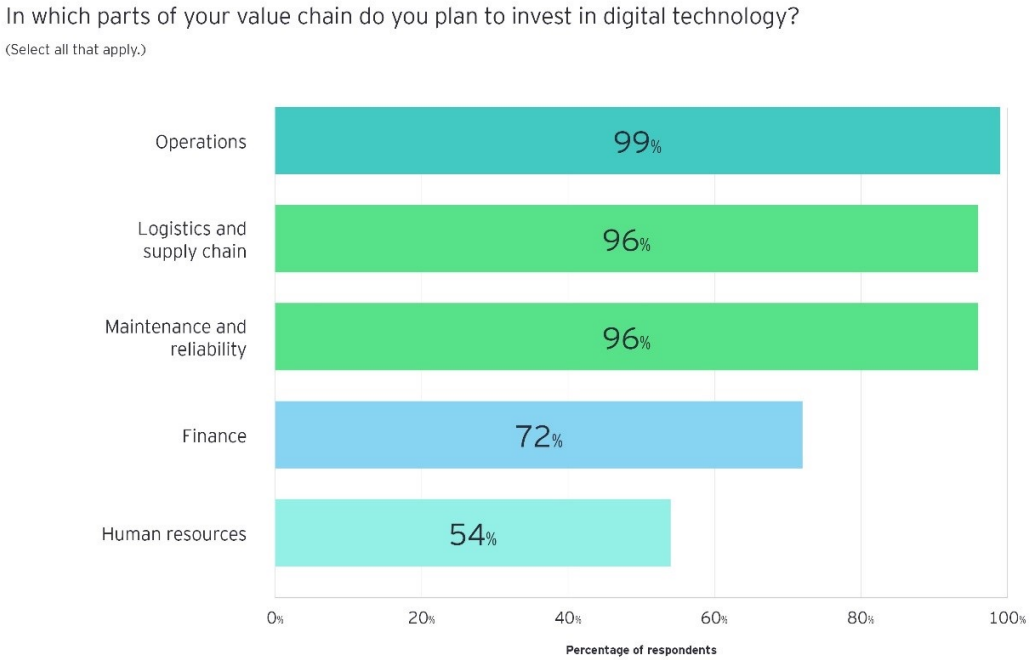
Nerelerde dijitalleşme

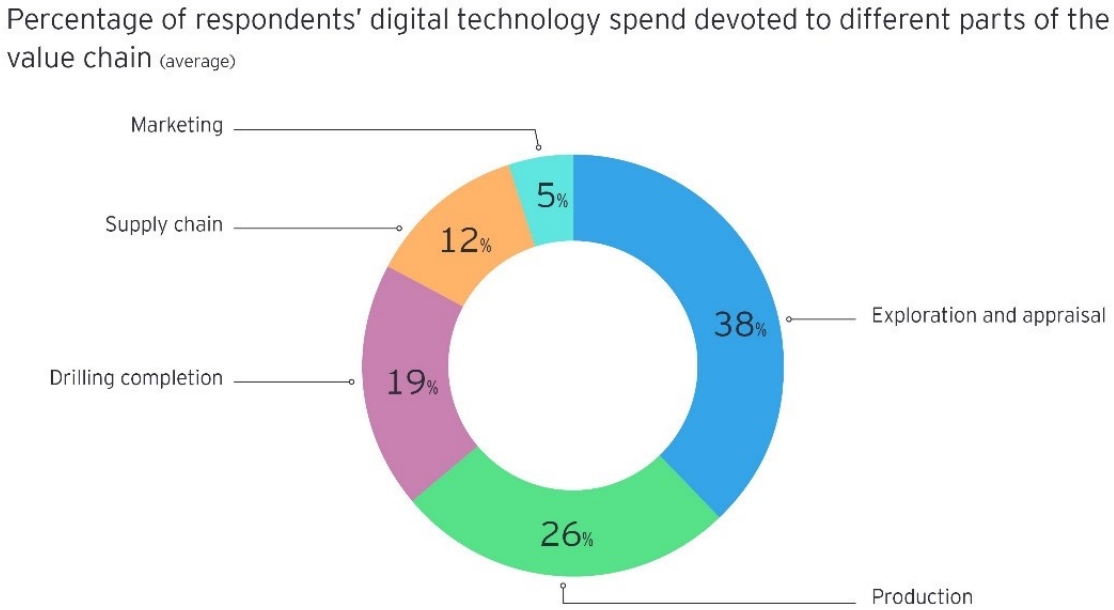




https://www.ey.com/en_gl/oil-gas/technology-can-light-the-way--but-do-you-know-where-you-re-going

Değer zincirinde dijitalleşme





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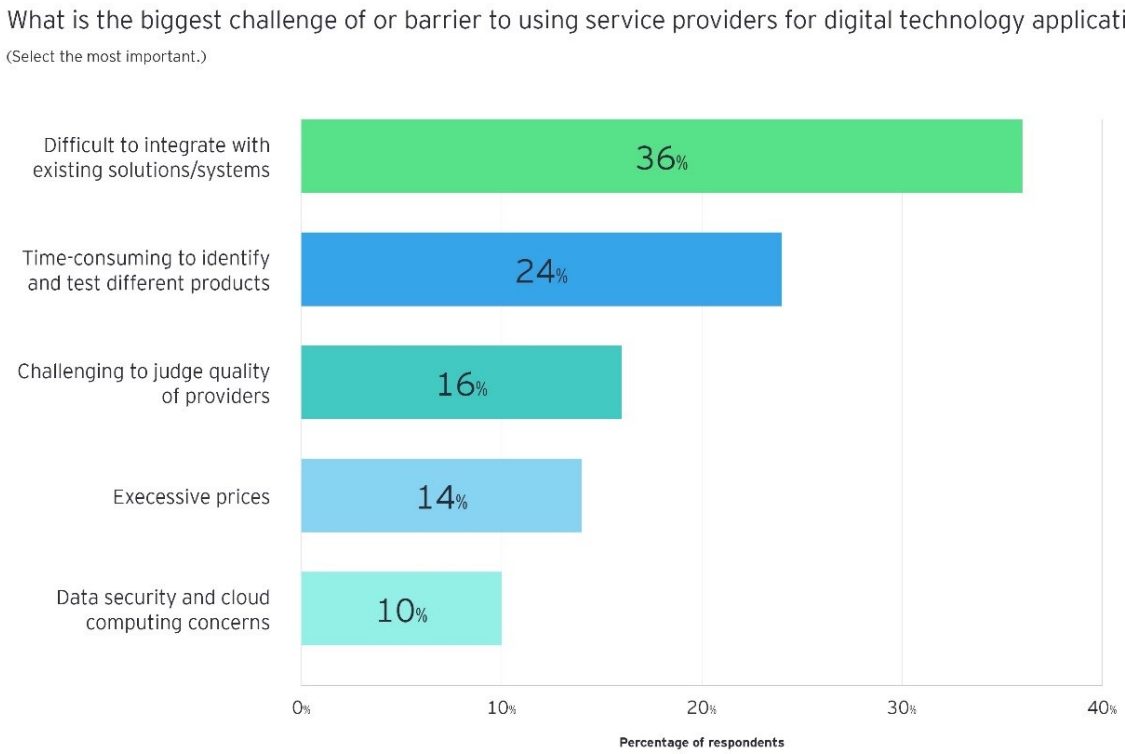
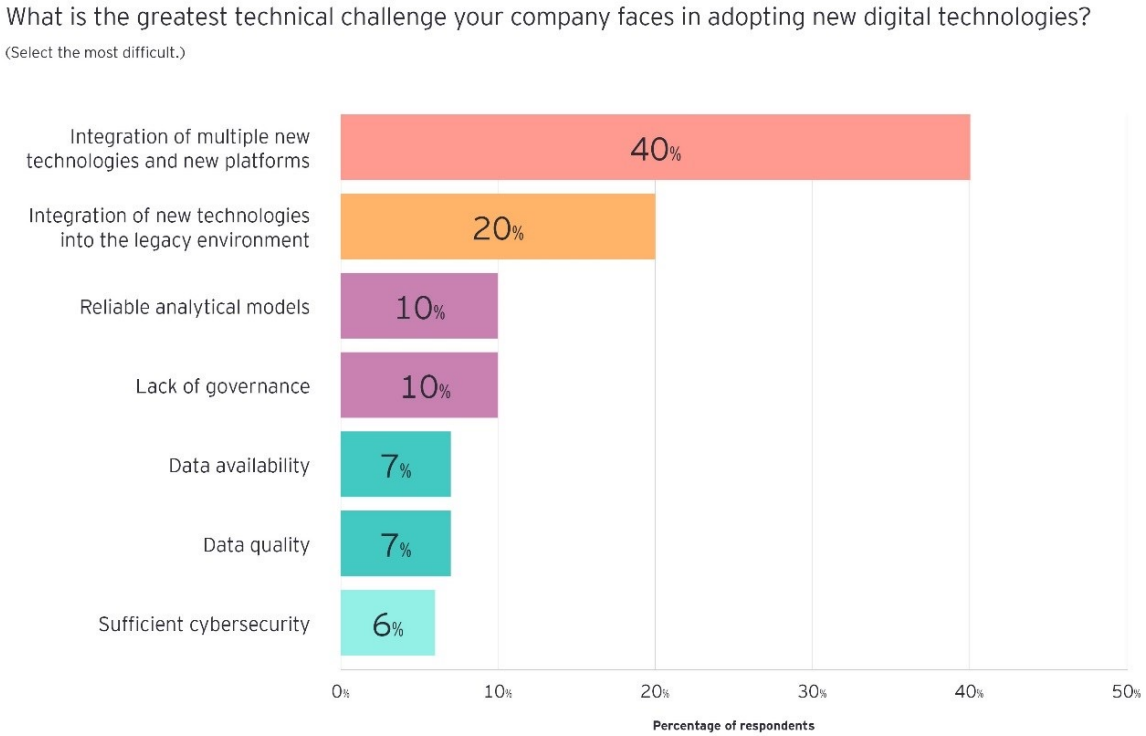
Değer zincirinde dijitalleşme





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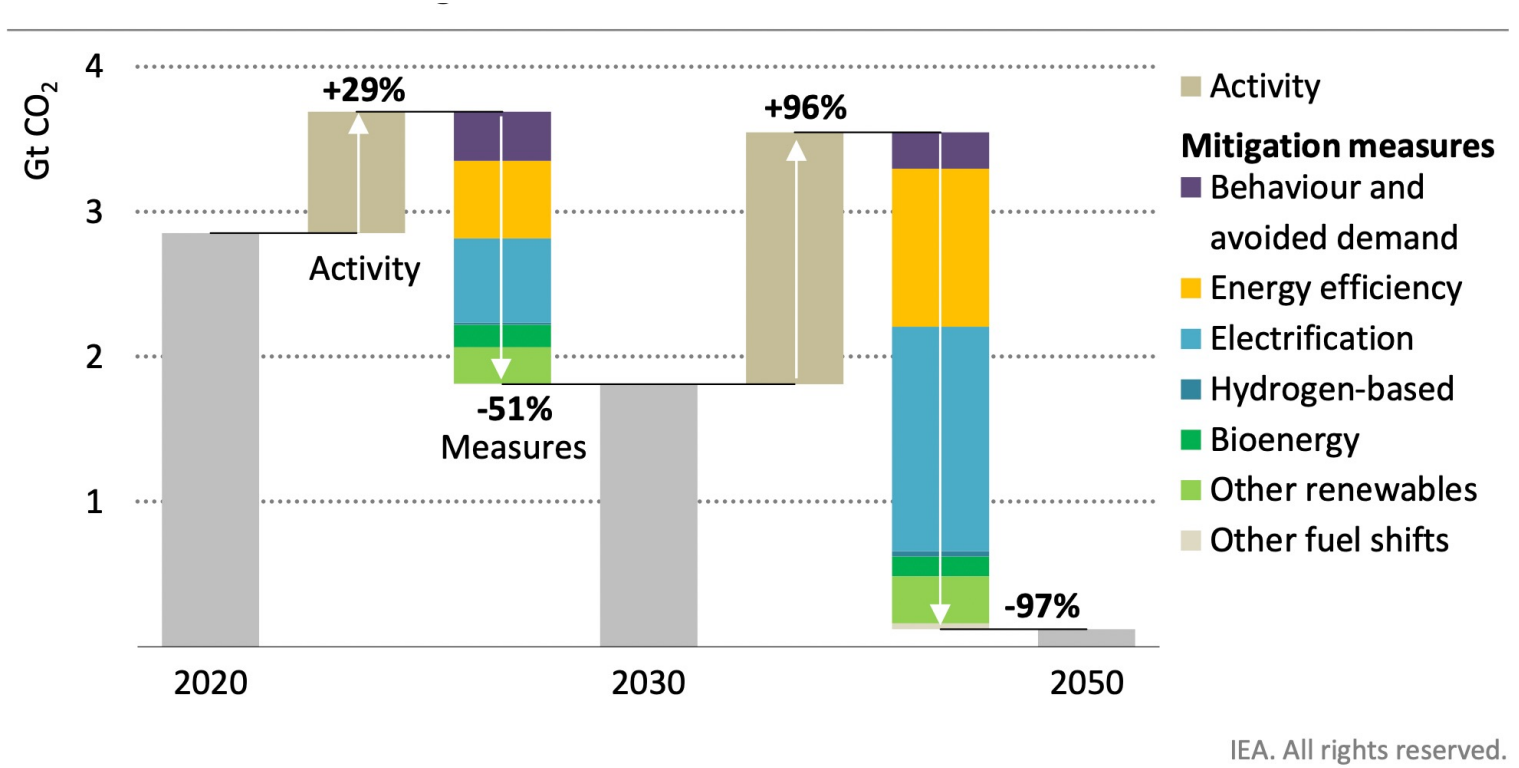
Net Sıfır Emisyon IEA



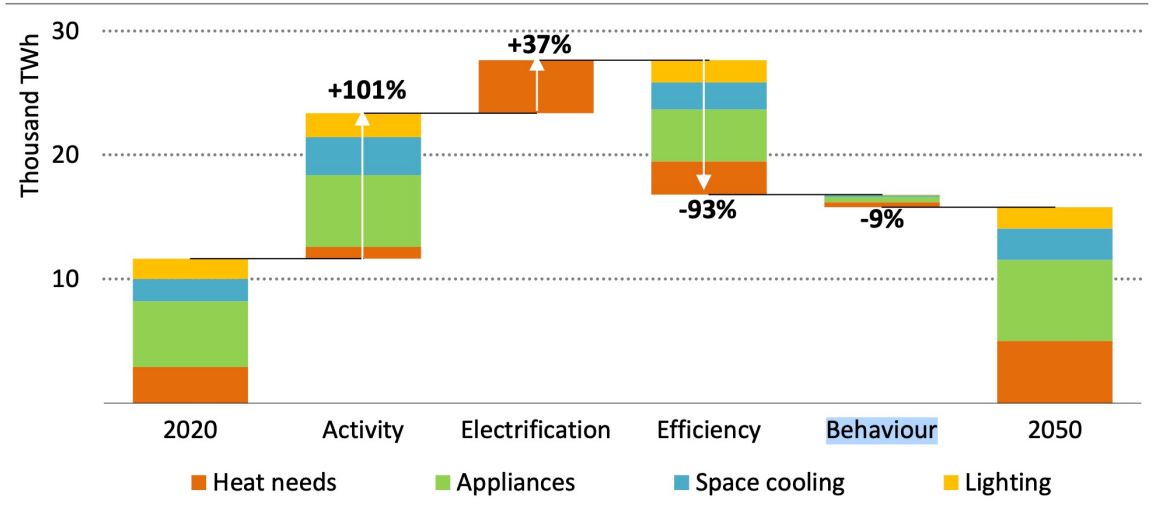
Electrification and energy efficiency account for nearly 70% of buildings-related emissions reductions through to 2050, followed by solar thermal, bioenergy and behaviour

Notes: Activity = change in energy service demand related to rising population, increased floor area and income per capita. Behaviour = change in energy service demand from user decisions, e.g. changing heating temperatures. Avoided demand = change in energy service demand from technology developments, e.g. digitalisation.

https://www.iea.org/reports/net-zero-by-2050

Digitalleşme: 3 – Davranış : 88

Figure 3.30 ▷ Global change in electricity demand by end-use in the buildings sector



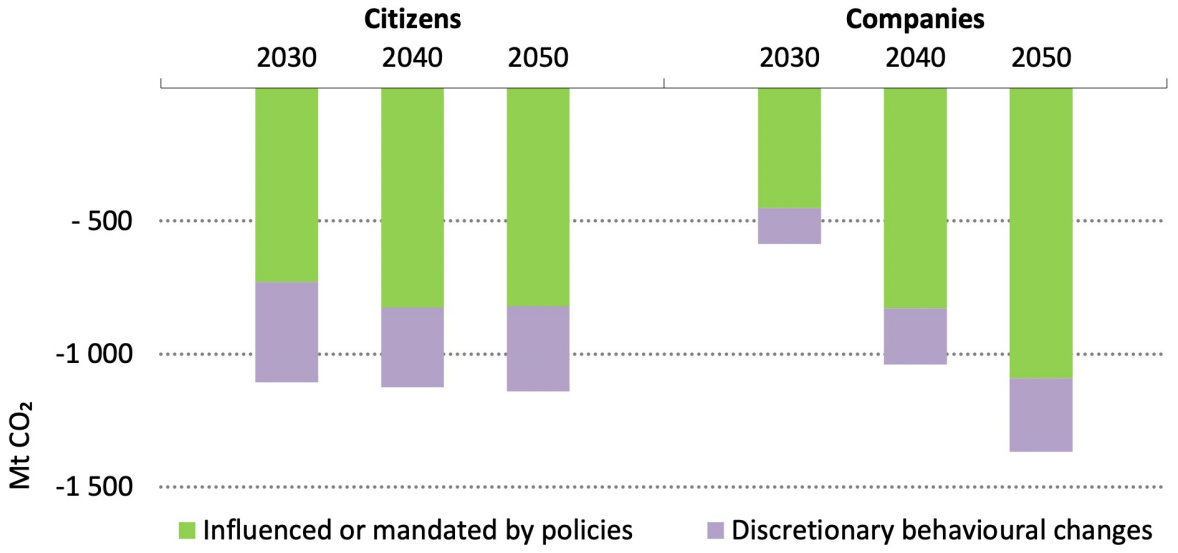
Energy efficiency is critical to mitigate electricity demand growth for appliances and air conditioning, with savings more than offsetting the impact of electrifying heat

Category	2020	2030	2050
Buildings			
Share of existing buildings retrofitted to the zero-carbon-ready level	<1%	20%	>85%
Share of zero-carbon-ready new buildings construction	5%	100%	100%
Heating and cooling			
Stock of heat pumps (million units)	180	600	1 800
Million dwellings using solar thermal	250	400	1 200
Avoided residential energy demand from behaviour	n.a.	12%	14%
Appliances and lighting			
Appliances: unit energy consumption (index 2020=100)	100	75	60
Lighting: share of LED in sales	50%	100%	100%
Energy access			
Population with access to electricity (billion people)	7.0	8.5	9.7
Population with access to clean cooking (billion people)	5.1	8.5	9.7
Energy infrastructure in buildings			
Distributed solar PV generation (TWh)	320	2 200	7 500
EV private chargers (million units)	270	1 400	3 500

https://www.iea.org/reports/net-zero-by-2050

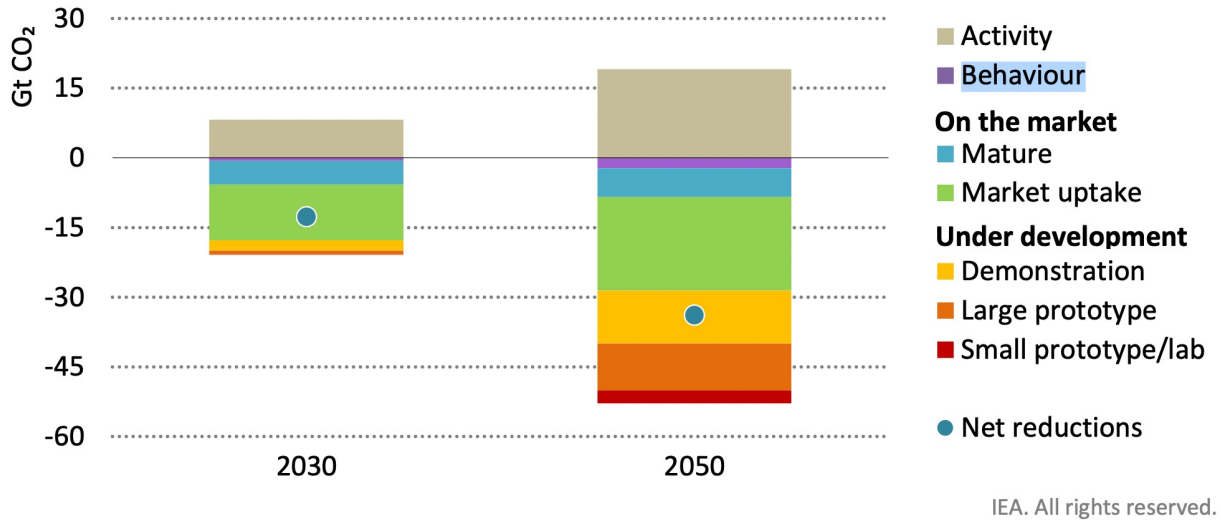
Dijitalleşme bir davranış değiştirme yöntemi ?

Figure 4.16 ▷ **Emissions reductions from policy-driven and discretionary behavioural changes by citizens and companies in the NZE**



Three-quarters of the emissions saved by behavioural changes could be directly influenced or mandated by government policies

Figure 4.22 ▷ **Global CO_2 emissions changes by technology maturity category in the NZE**



While the emissions reductions in 2030 mostly rely on technologies on the market, those under development today account for almost half of the emissions reductions in 2050

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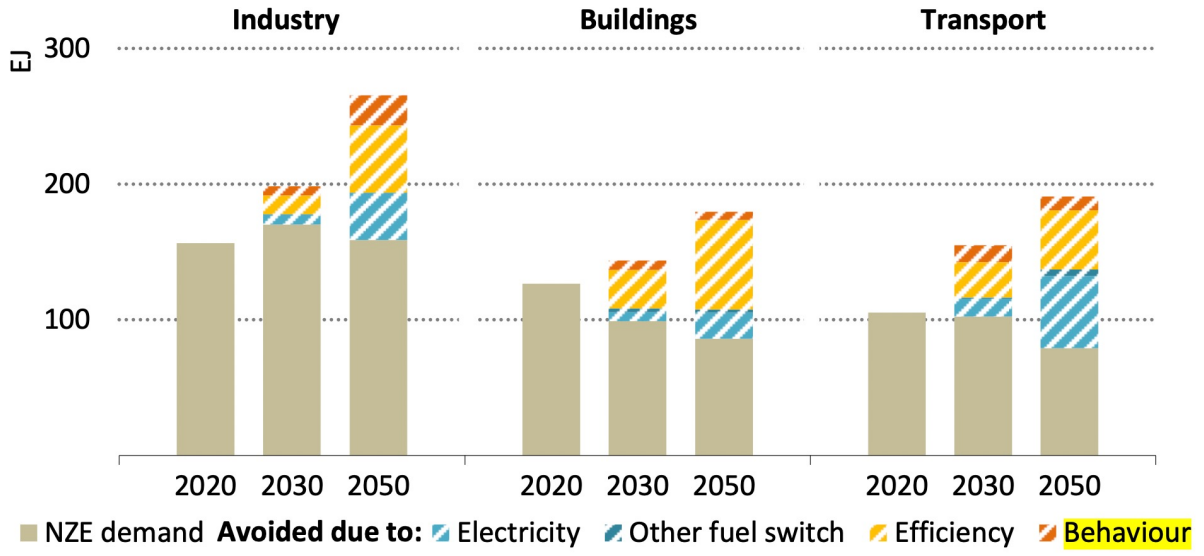
Verimlilik

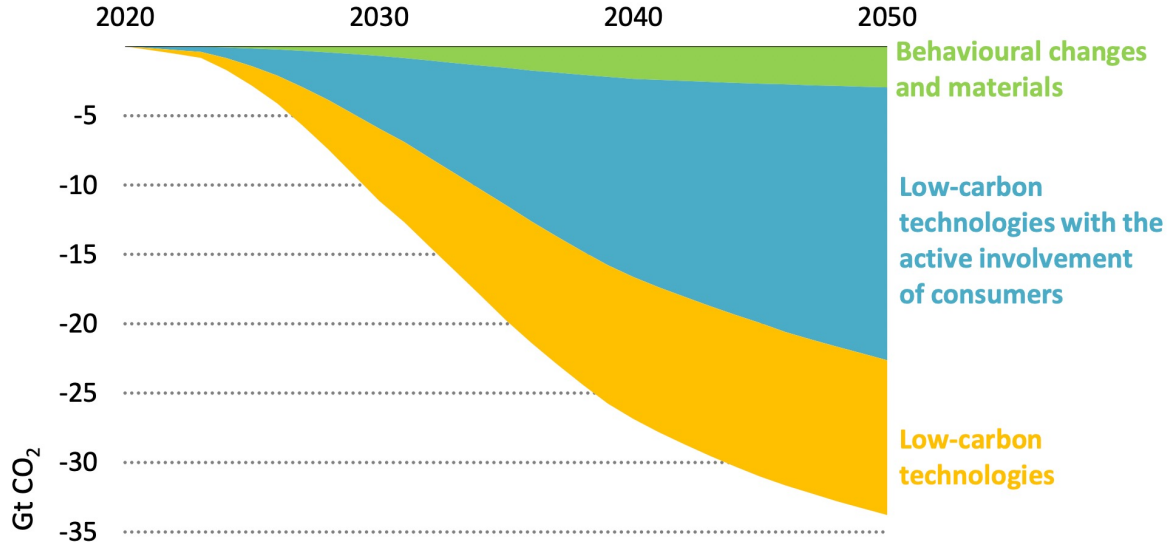
Figure 2.13 ▷ **Total final consumption and demand avoided by mitigation measure in the NZE**



Energy efficiency plays a key role in reducing energy consumption across end-use sector

Notes: CCUS = carbon capture utilisation and storage. Other fuel switch includes switching to hydrogen-relate fuels, bioenergy, solar thermal, geothermal, or district heat.

Figure 2.14 ▷ **Role of technology and behavioural change in emissions reductions in the NZE**



Around 8% of emissions reductions stem from behavioural changes and materials efficiency

https://www.iea.org/reports/net-zero-by-2050

Önemli sorular

- 3 boyutlu TV'ler neden tutmadı? Tüketici basit sever
- Tüketici elektrikli arabaları tercih edecek mi? Zaman alabilir
- Dağıtık bir enerji sistemi geliyor mu? Görünen kadarı ile hayır
- Fosil kaynakların sonu mu? Sıfır ile net sıfır farkı? «Unabated'e dikkat»
- Tüketici değişmek istiyor mu? Tabii ki hayır, covid örneği
- Dijitalleşme daha fazla insani bilimleri öne mi çıkarıyor? «Evet»
- Elektrifikasyon nasıl hızlanır? «Isı pompaları fakat kemikleri ısıtmaz»
- Yeni kavramlar - MW eşdeğer «1000 MW Güneş = 250 MW baz yük»
- Dijitalleşme diyoruz ama hep Python tarafındayız, çip-sensör tarafı tamamen ihmal edilmiş görünüyor. «Dijitalleşme sadece yazılım değildir»
- Enerji dönüşümünün kendi aklı ve hızı mı var? «İnsanın değişime direnci»

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